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REMARKS

1. Claims 1-17 and 37-40 are pending in the present application. With the present submission, withdrawn claims 18-36 are canceled and new claims 37-40 are added. Support for the new claims can be found, for example, at page 3, lines 13-29.

2. In the Final Action of January 29, 2007 the Examiner rejects claims 1, 2, 8, 9, 12 and 17 under 35 USC 103(a) as being unpatentable over U.S. Pat. No. 3,517,437 to Szobonya. Applicants respectfully disagree.

Independent claim 1 recites an "*un-sintered ceramic sheet*" and a "*wire*" which are "*fir[ed] . . . to a temperature sufficient to* <u>*sinter*</u> *the sheet material and . . . form a hermetic compression seal around [the] wire.*" Similarly, amended independent claim 8 recites "*firing [the] sheet and wires to* <u>*sinter*</u> *and shrink [the] ceramic material to form a hermetic compression seal around each wire.*"

Both claims 1 and 8 recite "sintering." According to Wikipedia, "sintering is a method for making objects from powder by heating the material (below its melting point) until its particles adhere to each other." A similar definition can be found in <u>www.dictionary.com</u>" "To cause (metallic powder, for example) to form a coherent mass by heating without melting. These references are enclosed with the present response.

The above definitions are consistent with the specification of the present application (see, by way of example and not of limitation, page 2 lines 32-33; page 6 lines 20-24; and page 7 lines 1-3), where it is specified that the wire does not melt. In particular, at page 7 lines 1-3 it is specified that the platinum wire flows and fills crevices because of its "plasticity", not because of melting.

In Szobonya, just shrinkage is disclosed, not sintering. Shrinkage can occur in view of many processes, most of them completely unrelated to sintering. In Szobonya, the article (which includes a base member of refractory material and a terminal pin serrated, knurled

or otherwise roughened) is heated until shrinkage occurs. In particular, "during the firing process shrinkage of the base member causes the refractory material to fill the spaces between and above the serrations or knurlings, thus eliminating the spaces into which the conducting material forming the electrical element terminating means might otherwise flow" (Szobonya, column 2 lines 20-25). Moreover, there is no disclosure of "sintering" in the passage at column 3 lines 23-63. While a consequence of sintering can be shrinkage (as also claimed by applicants in claim 8), shrinkage does not necessarily imply sintering. To the contrary, sintering is a particular species of shrinking where, as explained above, the particles of the ceramic sheet adhere to each other and to the particles of the wire, without melting.

In view of the above, Applicants submit that the Examiner cannot make a prima facie 35 USC 103(a) case against independent claims 1 and 8, which are unobvious over Szobonya. Dependent claims 2, 9, 12 and 17 are also deemed to be unobvious, at least by virtue of their dependency on independent claims 1 and 8.

3. In the Final Action of January 29, 2007 the Examiner rejects claims 1-17 under 35 USC 103(a) as being unpatentable over U.S. Pat. No. 5,368,220 to Mizuhara and U.S. Pat. No. 3,999,004 to Chirino. The Applicants respectfully disagree.

In particular, the Examiner states that Mizuhara's ceramic article would be sintered at the end of Mizuhara's manufacturing process. However, in Mizuhara, the article is heated to a predetermined temperature to achieve a <u>brazing reaction</u> (Mizuhara, column 4 lines 30-41), wherein "by the term of 'brazing reaction' it is meant to mean the occurrence of the requisite <u>reduction-oxidation</u> (red-ox) <u>reaction at the interface</u> of the active alloy and the ceramic article <u>whereby a chemical bond is achieved at the interface</u>. As will be recognized by one skilled in the art, the <u>brazing temperature</u> will, in most instances, <u>be at or near the liquidus temperature for the active alloy</u>." (Mizuhara, column 4 lines 42-48).

Brazing identifies a reaction, occurring upon heating of the article, that is different from sintering, as recited in independent claims 1 and 8. In the "brazed" article, the wire will

be at a temperature "close to the liquidus temperature of the wire", while in the "sintered" article, the particles of the ceramic sheet would adhere to each other and to the particles of the wire without melting.

Therefore, Applicants submit that the Examiner cannot make a prima facie 35 USC 103(a) case against independent claims 1 and 8 based on Mizuhara and Chirino. Also the other claims 2-7 and 9-17 are deemed to be patentable, at least by virtue of their dependency on independent claims 1 and 8.

4. New claims 37-40 are added herewith. Applicants submit that those claims are patentable in view of the art cited by the Examiner.

* * * * *

In view of the above, reconsideration and allowance of all the claims are respectfully solicited.

The Commissioner is authorized to charge any additional fees, which may be required or credit overpayment to deposit account no. 50-0922, including the required one-month extension fee. In particular, the Commissioner is authorized to treat this response as including a petition to extend the time period pursuant to 37 CFR 1.136 (a) requesting an extension of time of the number of months necessary to make this response timely filed and the petition fee due in connection therewith may be charged to deposit account no. 50-0922.

I hereby certify that this correspondence is being facsimile transmitted to the U.S. Patent and Trademark Office (Patent Central FAX Number (571) 273-8300) on

May 25, 2007
(Date of Transmission)

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(Signature)

May 25, 2007
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Enclosures:
- Transmittal Form
- Request for RCE
- Fee Transmittal Form
- Petition for Extension of Time under 37 CFR 1.136(a)
- Definition pages downloaded from the Internet

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Sintering

From Wikipedia, the free encyclopedia

Sintering is a method for making objects from powder, by heating the material (below its melting point) until its particles adhere to each other. Sintering is traditionally used for manufacturing ceramic objects, and has also found uses in such fields as powder metallurgy.

The word "sinter" comes from the Middle High German *Sinter*, a cognate of English "cinder".

Sintered bronze in particular is frequently used as a material for bearings, since its porosity allows lubricants to flow through it. In the case of materials with high melting points such as Teflon and tungsten, sintering is used when there is no alternative manufacturing technique. In these cases very low porosity is desirable and can often be achieved.

Sintered Bronze and Stainless steel are used as filter materials in applications requiring high temperature resistance and at the same the ability to regenerate the filter element. For example, sintered stainless steel elements are used for filtration of steam in food and pharmaceutical applications.

In most cases the density of a collection of grains increases as material flows into voids, causing a decrease in overall volume. Mass movements that occur during sintering consist of the reduction of total porosity by repacking, followed by material transport due to evaporation and condensation from diffusion. In the final stages, metal atoms move along crystal boundaries to the walls of internal pores, redistributing mass from the internal bulk of the object and smoothing pore walls. Surface tension is the driving force for this movement.

Metallurgists can sinter most, if not all, metals. This applies especially to pure metals produced in vacuum which suffer no surface contamination. Many nonmetallic substances also sinter, such as glass, alumina, zirconia, silica, magnesia, lime, ice,beryllium oxide, ferric oxide, and various organic polymers. Sintering, with subsequent reworking, can produce a great range of material properties. Changes in density, alloying, or heat treatments can alter the physical characteristics of various products. For instance, the tensile strength E_n of sintered iron powders remains insensitive to sintering time, alloying, or particle size in the original powder, but depends upon the density (D) of the final product according to $E_n/E = (D/d)^{3.4}$, where E is Young's modulus and d is the maximum density of iron.

Particular advantages of this powder technology include:

1. the possibility of very high purity for the starting materials and their great uniformity
2. preservation of purity due to the restricted nature of subsequent fabrication steps
3. stabilization of the details of repetitive operations by control of grain size in the input stages
4. absence of stringering of segregated particles and inclusions (as often occurs in melt processes)
5. no requirement for deformation to produce directional elongation of grains

Many literary references exist on sintering dissimilar materials for solid/solid phase compounds or solid/melt mixtures in the processing stage. Any substance which melts may also become atomized using a variety of powder production techniques. When working with pure elements, one can recycle scrap

remaining at the end of parts manufacturing through the powdering process for reuse.

Ceramic sintering

Sintering is part of the firing process used in the manufacture of pottery and other ceramic objects. Some ceramic raw materials have a lower affinity for water and a lower plasticity index than clay, requiring organic additives in the stages before sintering. The general procedure of creating ceramic objects via sintering of powders includes:

- Mixing water, binder, deflocculant, and unfired ceramic powder to form a slurry
- Spray-drying the slurry
- Putting the spray dried powder into a mold and pressing it to form a *green body* (an unsintered ceramic item)
- Heating the green body at low temperature to burn off the binder
- Sintering at a high temperature to fuse the ceramic particles together

There are two types of sintering: with pressure (also known as hot pressing), and without pressure. Pressureless sintering is possible with graded metal-ceramic composites, with a nanoparticle sintering aid and bulk molding technology. A variant used for 3D shapes is called hot isostatic pressing.

Two classics texts which describe the science of sintering in ceramics are:

Introduction to Ceramics, 2nd Edition
by W. David Kingery, H. K. Bowen, & Donald R. Uhlmann
John Wiley, Academic Press, 1976
and
Physical Ceramics
by Y-M. Chiang, D. Birnie III, and W.D. Kingery
John Wiley & Sons, 1997

See also

- Selective laser sintering, a rapid prototyping technology.

Retrieved from "http://en.wikipedia.org/wiki/Sintering"

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American Heritage Dictionary - *Cite This Source*

sin·ter (sĭn'tər) Pronunciation Key

n.

1. *Geology* A chemical sediment or crust, as of porous silica, deposited by a mineral spring.
2. A mass formed by sintering.

v. **sin·tered, sin·ter·ing, sin·ters**

v. *tr.*
To cause (metallic powder, for example) to form a coherent mass by heating without melting.

v. *intr.*
To form a coherent mass by heating without melting.

[German, from Middle High German, *dross, metal slag*, from Old High German.]

sin'ter·a·bil'i·ty *n.*

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